*Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period: \_\_\_\_\_\_*

**Must-Knows: Unit 11 (Organism Form and Function)**

Ms. Ottolini, AP Biology

**Test Format:** 18 multiple choice questions, 1 short answer question

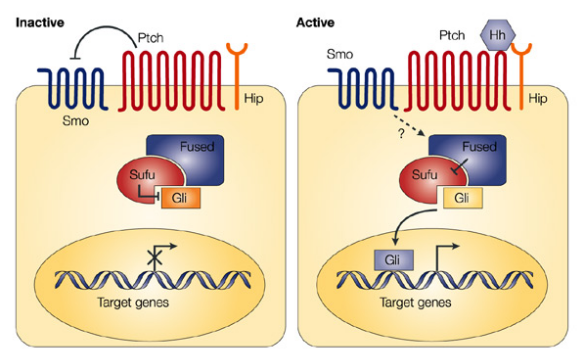
**Topic #1: Development**

**Learning Target #1:** I can describe the role of cytoplasmic determinants and homeotic genes in pattern formation.

**Learning Target #2:** I can describe the role of apoptosis in morphogenesis.

**Learning Target #3:** I can describe the role of transcription factors, RNA interference, embryonic induction, environmental cues, etc. in cell differentiation.

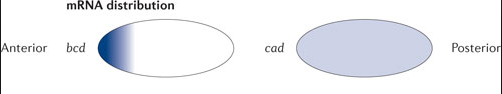
1. Explain the role of homeotic genes in pattern formation during embryonic development.
2. Explain the role of apoptosis in morphogenesis during embryonic development.
3. Explain the role of embryonic induction in cell differentiation during embryonic development.



The Hedgehog protein (Hh) plays a critical role during a certain period of embryo development. As illustrated in the figure to the right, when Hedgehog is present, it binds to membrane proteins Ptch and Smo. Activated Smo interacts with a complex of proteins, which eventually results in the activation of a Gli transcription factor that stimulates the transcription of target developmental genes in the nucleus. The image on the left shows the signaling pathway when Hedgehog is not present.

1. Suppose a scientist injects a compound that prevents the activation of Smo in the presence of the hedgehog protein. How will this affect the amount of transcription of the genes in the nucleus?

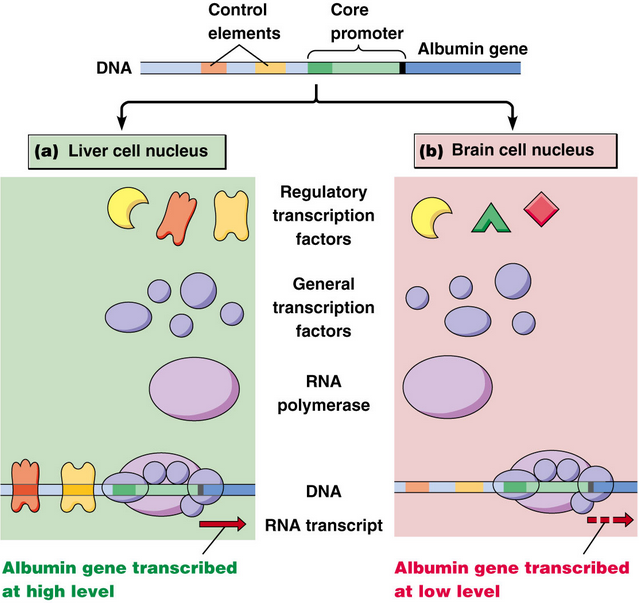
Two different genes are known to be involved in the development of different body regions of *Drosophila* fruit flies. The diagram below shows the distributions and levels of mRNA transcribed from two different genes (bicoid and caudal) in different locations in a *Drosophila* egg immediately before fertilization. Note: *bcd* stands for bicoid mRNA and *cad* stands for caudal mRNA



The diagram below shows the distributions and levels of the two corresponding proteins along the body after fertilization. Note: BCD stands for bicoid protein and CAD stands for caudal protein.



1. How will the removal of caudal mRNA affect the distribution of bicoid protein in the fertilized egg?



1. The image to the right shows the regulation of transcription of the albumin gene in liver cells vs. brain cells. Based on the diagram, why is the albumin gene transcribed at a higher level in liver cells?

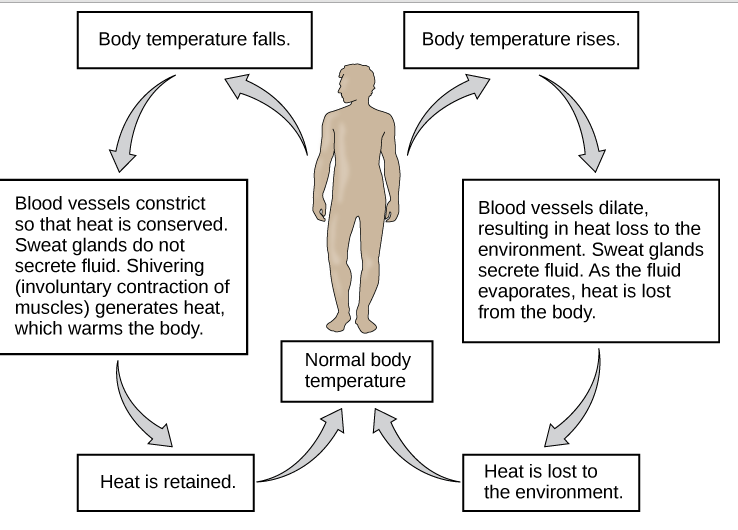
**Topic #2: Timing and Coordination**

**Learning Target #4:** I can describe how living organisms respond to environmental cues to coordinate physiological events

**Learning Target #5:** I can describe how the coordination of behaviors in organisms can be an advantage in natural selection.

**Learning Target #5:** I can compare the types of DNA mutations and their effects on the resulting protein.

1. Explain how the human respiratory and circulatory systems work together to deliver oxygen-rich blood to the tissues of the body and remove excess carbon dioxide from the body.
2. Explain how auxin hormone is used in the phototropism response in plants.
3. Explain the difference between long-day plants and short-day plants. Use the term photoperiodism in your response.



1. The image to the right shows the physiological changes that occur within the human body in response to changes in body temperature. Suppose an individual is given a drug that causes involuntary muscle contractions (shivering) in the absence of a cold stimulus. What will be the immediate effect on body temperature?
2. Explain the difference between an innate and learned behavior.
3. Explain how a fixed action pattern is initiated and provide an example in a real group of organisms (Hint: check your notes!). Is this an example of an innate or a learned behavior?

**Topic #3: Defense (The Immune System)**

**Learning Target #6:** I can describe the non-specific (innate) responses of both plants and animals to pathogens.

**Learning Target #7:** I can describe the specific immune response in mammals.

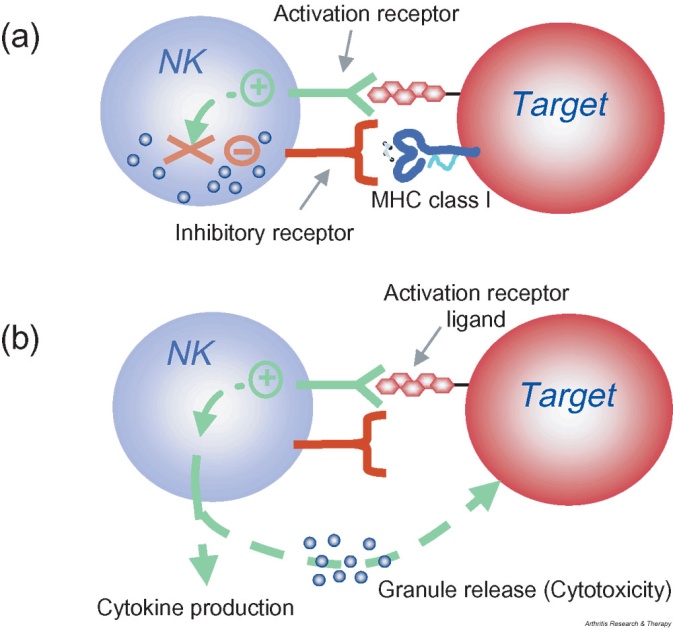
13. Explain the difference between the nonspecific and specific immune responses in humans.

14. Explain how macrophages destroy antigens (full bacteria / viruses or parts of bacteria / viruses) that they determine to be “non-self” (foreign / not part of the human body).

15. Explain how the secondary immune response is initiated. Is this response smaller or larger than the initial (primary) immune response?

16. How are macrophages (aka Antigen-Presenting Cells) and Helper T lymphocytes used to initiate the specific immune response?

17. Explain the difference between the humoral and cell-mediated immune responses.



18. All normal, healthy body cells have MHC-1 proteins on their cell surfaces. A natural killer (NK) cell (another name for cytotoxic T cells) is produced by the immune system and has inhibitory receptors that bind to MHC-1 proteins. When an NK cell binds to a normal body cell, it recognizes the MHC-1 protein, “turns off,” and does not destroy the cell. If, however, the NK cell binds to a cell lacking the correct MHC-1 protein, the NK cell is “turned on” and releases cytotoxic substances that destroy the cell.

Suppose a normal body cell cannot produce normal MHC-1 proteins. How will this affect the process shown to the right?

19. How does HIV (Human Immunodeficiency Virus) affect the human immune system?